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RECORD OF OPERATIONS IN CAKE MAKING.

To determine the variables in a baking problem, an analysis of the operations involved is necessary.

In cake-making, the data needed in describing fundamental processes which determine the quality of the product are as follows:

1. Serial number, or other method of designating each individual cake.
2. Formula used, giving measures and weights of all ingredients.
3. Description of ingredients used. E. g., "Swansdown blend of corn flour and wheat flour;" "Pittsfield, Illinois, soft winter wheat, bread flour," etc. In some cases it is best to designate time and place of purchase, as many wheat flours show the effect of storage on "ageing" or increase in strength. Liquid should be designated, as water, sweet or sour or clabbered milk, etc. Sugar should be designated, as to fineness; baking powder, as to kind (double action, tartrate, straight phosphate, kind of phosphate used, etc.); sirups or molasses should be identified by their trade names, also described if necessary. Fats are designated by trade names (as Wesson oil, Crisco), whether hard, or melted, or oils; they should be named, and described if necessary. Whole eggs, whites, or yolks may be specified as to number as well as by weight.
4. Addition of special ingredients, such as chocolate, nuts, etc. often calls for description as well as for trade names.
5. Manipulation. (See "Fifteen Projects in Experimental Cake Making", Denton and Dow) This includes:
 - a. Temperature of ingredients. (Fat, liquid).
 - b. The order in which ingredients are put together. All details should be carefully standardized, for example, if

liquid and flour are added alternately the amounts added at each stage should be definitely stated. Method of adding baking powder (whether before or after beating) is of special importance.

METHODS OF MIXING BUTTER CAKES.

Three of the methods most used are as follows:

(1) Conventional Method. Creaming of butter, or fat, then of butter and sugar together, then of beaten yolks with fat and sugar, addition of liquid and dry ingredients (sifted together), alternately, adding about $1/3$ of the whole at each time; beating; folding into batter, of beaten whites. Specify time and rate of beating.

(See 5 c. below.)

(2) Muffin method. Mix all dry ingredients together and all liquid ingredients together, and combine the two mixtures.

(3) Cake Mixer Method. Put all ingredients at once into bowl or mixer, and mix thoroly together by beating manually or by machinery.

a. Not only length of time of beating, but also implements used, (size, material,) and number of strokes given, or turns of egg beater should be estimated and recorded. Some workers beat perhaps twice as fast as others, consequently the cake would in this case get twice as much beating in the same length of time.

6. Description of pan in which cake is baked. This includes:

a. Material of which the pan is made. Surface; glazed or rough.

b. Shape or form of pan, number of pans used.

c. Dimensions. Height of sides above top of batter, when first put in; below it, after baked. In case the pan extends extremely high above the batter, does this accelerate or retard the baking process?

7. Oven in which baking is done. Size (inside dimensions), material, thickness of walls, fuel, how heat is applied, etc. Draft and humidity conditions; whether products of combustion circulate in oven or outside it.

8. Weight of cake batter just before baked.

9. Record of time and oven temperature during baking. It is not sufficient, to record temperature of oven at beginning and end of the baking period; a more complete record is needed. The most satisfactory way in which to get a complete record of oven temperature is to draw a curve in which oven temperatures are plotted as ordinates and time intervals as abscissae. Observations may be taken every five minutes, or at any convenient interval.

10. Temperature of center of cake when first taken from the oven. Even better than this would be a continuous record of temperatures attained during the baking process in the center of the mass of dough. Such records can be made by a thermocouple with terminals placed in the cake batter and connected to a suitable recording apparatus. However, the temperature as taken at the end of the baking period by the use of an ordinary chemical thermometer is a very useful indication. What kinds of cakes attain the temperature of boiling water when "done"? What degree of sterilization would result? of vitamine destruction?

11. Weight of cake after baking, after a specified interval which is always the same (e. g., 30 minutes). It is of course unfair to compare weight when freshly baked with that taken after standing, since evaporation

of moisture is constantly taking place, with concomitant changes in texture.

12. Percentage loss of weight during baking. This is obtained by subtracting "weight after baked" from "weight before baked" and dividing the difference by "weight before baked". In a given series of experimental cakes of identical moisture content in batter, this figure indicates degree of thoroughness of baking. Does a high percentage loss in baking, necessarily correspond in any degree, to an unusually low specific volume? to an unusually high specific volume?

13. Score card.

a.	Shape, color, general appearance. Flat, rounded, or peaked top? Cracked or smooth surface?	10
b.	Crust. Is it crisp? Tender? Tough? Is it thin or light? Is it sugary even when the cake is cold?	10
c.	Crumb. (1) Texture (tenderness or toughness, stickiness or dryness). (2) Color. (3) Grain. (Are the pores small and fine; are they uniform in size? Is there tunneling? Are the walls of the pores thin or thick? Is the mass loose or compact?)	30
d.	Flavor (rather than "feel" in the mouth, which really depends chiefly on texture). Are flavors well blended so that no single flavor stands out too predominantly? (It must be remembered, that the mouth is very sensitive to texture as well as to flavor proper. An effort should be made, how-	30

ever, to distinguish flavor from texture, in recording this judgment.)

e. Lightness or specific volume. This is best measured in a suitable graduated glass cylinder or jar which may be filled with rape seed, or with some small spherical seeds of uniform size. The cake should be supported on a wire or other support so that its weight does not pack the seed underneath it. All precautions should be taken to prevent uneven packing of the seed. E. g., the cake should be placed always at about the same height in the jar, the seed should be poured in from a scoop or spoon held at about the same height above the jar, etc. If the jar is not a graduated one it may be used in the following way: Partly fill the jar with seed, add the cake in such position that its upper surface comes well below the top of the jar. Fill the jar with seed and level carefully, avoiding packing. Remove cake, being careful not to scatter seed. Fill jar from a graduated cylinder until level full, and observe the number of cubic centimeters of seed used in filling. This should give the volume of the cake. See that cake does not shrink under weight of seed; see that successive trials on the same cake, check reasonably well.

Specific volume is obtained, by dividing volume by weight (of cake after baked).

Note. - The specific volume of good yeast bread (all wheat) is usually from 3 to 4; of baking powder doughs without eggs, in the neighborhood of 2. One-egg cake

should make a specific volume between 2.2 and 2.6, in our experience.

f. Keeping qualities. Does it become dry or crumbly or sticky or soggy, sooner than it should, when kept under proper conditions? (Specify kind of container, how kept closed or covered, temperature, humidity, when and how cake is wrapped, if at all.)

14. Composition of cake as baked. Expressed as approximate percentages which the weight of fat, sugar, flour solids, milk solids, etc., form of the total weight of the cooked product. These data are of great interest from the standpoint of food values and dietetics. One of the great services to be rendered by the accumulation of exact data obtained from the methods of experimental cookery is the possibility of obtaining an approximate knowledge as to the percentage composition of some of these highly variable cooked foods.

Illustration No. 1.

One-Egg Cake.

Lard, 3 tablespoons	42 grams	
Sugar, $\frac{1}{2}$ cup	100 "	
Egg, one, contains solids equal to	12 "	(45 to 48 grams beaten contents, in 1 large egg)
Milk, $\frac{2}{3}$ cup, " " " "	20 "	
Flour, $1\frac{1}{2}$ cups, " " " "	<u>150</u> "	
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Weight of cake after baking, averages 460 grams.

% of sugar in baked cake	22%
" " fat " " "	9%
" " egg solids in baked cake	$2\frac{1}{2}\%$
" " milk solids in baked cake	4 1/3%
" " flour " " " "	33%
" " water " " " "	29%

Illustration No. 2.

Angel Cake.

Flour, $\frac{3}{4}$ cup, contains solids equal to	74 grams
Sugar, 1 cup " " " "	200 "
Egg whites, 8; " " " "	$\frac{39}{313}$ "

Weight of cake after baking, 420 grams.

% of sugar in baked cake	48%
" " flour solids in baked cake	18%
" " egg protein in baked cake	9%
" " water in baked cake	25%

15. When a given series of experimental cakes has been completed and fully recorded as above, results should be tabulated for the factors being studied. A statement of the purpose of the study should be made; references to previous work done along the same or similar lines, should be given; details of methods used, may be discussed; and a summary of conclusions arrived at, is then to be given.

Minna C. Denton

Office of Home Economics,

Washington, D. C.

Elizabeth W. Miller

Home Economics Division

Iowa State College

Ames, Iowa.

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HOW TO JUDGE CAKES.

The advantages of a loaf cake weighing about one pound when baked are apparent when it comes to judging experimental cake batters. For thus is minimized the influence of different degrees of rising and baking often so apparent among a dozen cup cakes baked at the same time from the same batter.

1. Weight and volume should be taken before judging begins. Thirty minutes after the cake is removed from the oven is a good time at which to start this work, - provided all cakes come out together. Otherwise, all cakes should be allowed to cool thoroughly, as it is manifestly unfair to compare a fresh warm cake with a stale one of the day before, or even of a few hours' standing.

2. Points a, b, and c (See score card, page 4 in Record of Operations in Cake Making) should be judged first, by at least four judges, working simultaneously if possible. The judgments should be recorded in writing, and without any oral discussion, so that the opinion of one judge does not influence the others. Point a should be judged before the cake is cut, b and c afterward. The knife should be sharp and the cake fairly cool, so as to make a clean cut and show the grain well. The cut should pass through the center of the cake. If the cake has to be judged while still warm, it should be split with two forks rather than cut.

3. The best way to judge a series of cakes for flavor (if time permits) is for each judge to receive from another person a small piece from the crumb of two cakes in succession, and try thus to identify the two samples among those which she knows to have been baked, or considers likely to have been tried.

She should, of course, in comparing two samples, also state which one she prefers, and why. The influence of texture is more nearly eliminated

if she takes pains not to handle the cake samples more than is necessary.

It is of great interest, to record judgments made with eyes closed.

One who has not tried this method of testing, is surprised to see how at a loss even the experienced cake-makers are, in judging a cake without their eyes to help them; and surprised again, to perceive the accuracy which some testers possess or can develop even in these "blind" tests.

Pains must be taken, to leave in the cake box, a piece of cake large enough to represent fairly, crumb as well as crust, and both in one piece. This piece is later to be used, in recording data on keeping qualities. It is well known that some recipes produce a cake which is good only when fresh, as it "stales" very rapidly.

